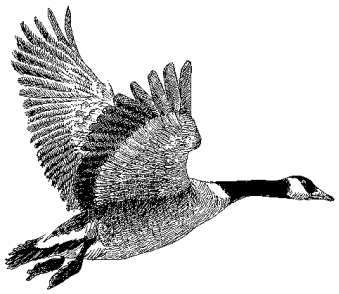
# A BREEDING PAIR SURVEY OF CANADA GEESE IN NORTHERN QUÉBEC - 2009



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Status of Canada geese (Branta canadensis) in the Atlantic flyway was traditionally monitored by mid-winter surveys. However, mixing of resident and migrant geese on wintering areas has seriously reduced the value of mid-winter surveys for monitoring populations. Therefore, emphasis of population monitoring has shifted to surveys on breeding areas, where population affiliation is more obvious.

During the 1960's, aerial surveys identified the Ungava Peninsula in northern Québec as the primary nesting area for Atlantic flyway Canada geese (Kaczynski and Chamberlain 1968). Malecki and Trost (1990) used a more quantitative approach to estimate the number of breeding pairs throughout the boreal forest and Ungava Peninsula of northern Québec in 1988. Their findings confirmed that the highest densities were located along the coastal areas of Ungava Bay and Hudson Bay. In 1993, an annual survey was initiated in northern Québec using methods developed by Malecki and Trost (1990) (Bordage and Plante 1993). The objective of this survey is to monitor the status of the migrant population by estimating the number of breeding pairs. This report presents the results of the 2009 breeding ground survey.

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## STUDY AREA

The survey was conducted in northern Québec, north of 51º latitude and west of 67º longitude (Figure 1). The survey is stratified based on Malecki and Trost's (1990) modification of northern Québec's ecoregions (Gilbert et al. 1985). The regions have been described by Malecki and Trost (1990) and Bordage and Plante (1993). Regions 1-3 comprise the area known as the Ungava Peninsula (Figure 1). Region 1 is comprised of inland tundra, with much of the surface covered by granitic bedrock. Region 2 consists mainly of flat coastal tundra, characterized by low relief and numerous ponds and lakes. Region 3 is taiga, with stunted black spruce and tamarack in protected valleys. Elevations range from 100 - 400 m in region 1, 0 - 200 m in

region 2, and 100-300 m in region 3. The northern tip of the coastal zone from Ivujivik, southeast to about 150 km north of Kangirsuk, was excluded (Figure 1). Exploratory transects flown in 1993 indicated that few geese use this mountainous area.

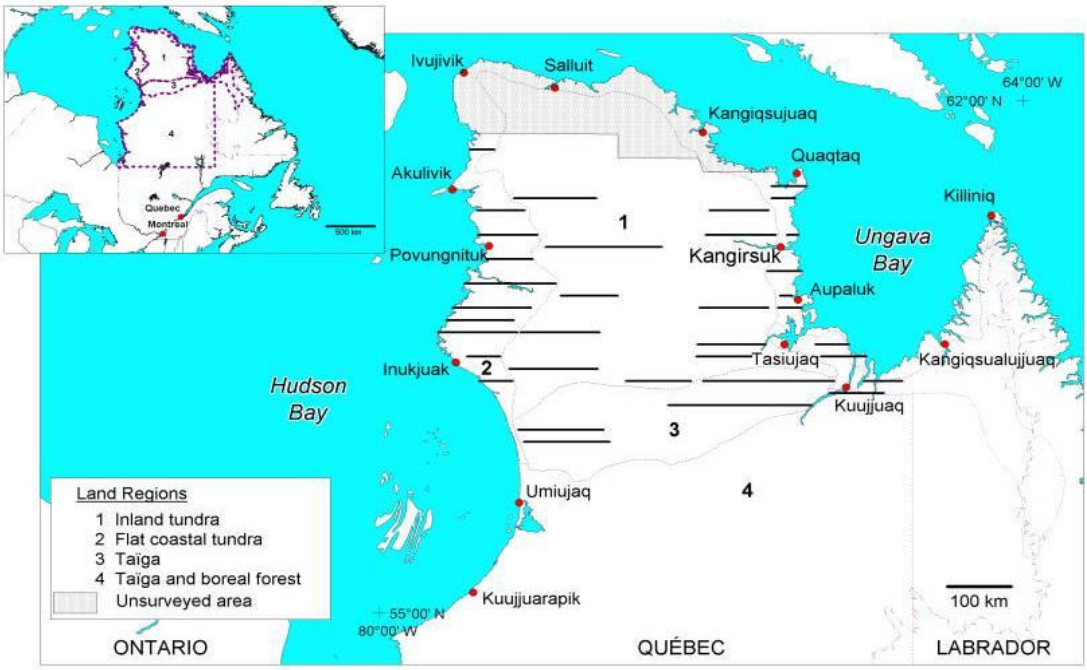


Figure 1. Study area and location of transects for the breeding pair survey in northern Québec.

## METHODS

The survey followed the methodology of Malecki and Trost (1990). Aerial transects were flown in a Partenavia twin engine at 30 m above ground level and a ground speed of 140 km/h. The survey is timed to cover the mid to late incubation period.

Transects were established in 1994 and repeated each year thereafter. Total length of transects sampled in each

region was determined using variance estimates from the 1993 survey and a target of 10% coefficient of variation (Bordage and Plante 1994). Transects were randomly located within regions until the desired length was reached. All transects were orientated along east-west lines (Figure 1).

Observers recorded the number of geese observed as singles, pairs, or in groups (3 or more geese) within 200 m of each side of the plane. We occasionally observed multiple pairs of geese in close association (< 10-15 m apart). We classified these geese as grouped birds, since they were unlikely to be associated with a territory. Observers also recorded similar information for other waterfowl species. Coordinates for each location were generated using a global positioning system (GPS) and stored on a lap-top computer. Transects were flown using a GPS to assist with navigation. Transect width was calibrated before the survey began.

The number of indicated breeding pairs on a given transect was the sum of the singles and pairs observed by both observers. Density of breeding pairs within regions was estimated using quotient estimators while the total population density was estimated using a separate stratified quotient estimator (Cochran 1977). Variances were estimated using the jack-knife procedure (Cochran 1977). The significance of differences in population size between years was assessed with a z-test, using the sum of the sampling variances for the 2 years being compared. We considered differences to be significant at the 0.10 level. The estimates presented in this report are not adjusted for visibility bias and thus represent an index to the population.

## RESULTS AND DISCUSSION

### Habitat Conditions and Spring Phenology

Transects were surveyed June 20-26. These dates are similar to surveys conducted during 1993-2008, but later than the 1988 survey (Table 1). Spring temperatures in 2009 were below normal, particularly along the Hudson Bay coast, where snow melt did not occur until early June (Aliva Tulugak, pers. commun.). In inland areas (regions 2 and 3), ice cover remained on all but small lakes and ponds or those with very shallow water. Large lakes remained frozen along both the Hudson and Ungava Bay coasts. Emergence of tree leaves and grasses was not evident along either the Ungava or Hudson Bay coast until the last days of the survey.

Table 1. Dates of Canada goose pair surveys conducted in northern Québec in 1988 and 1993-2009.

| Year | Survey Date | Peak Hatch Date - Hudson Bay | Peak Hatch Date - Ungava Bay |
|---|---|---|---|
| 1988 | 23 May - 3 June | | |
| 1993 | 11-21 June | | |
| 1994 | 21 June - 1 July | | |
| 1995 | 18-24 June | | |
| 1996 | 17-25 June | 7 July | 2 July |
| 1997 | 21-26 June | 29 June | 23 June |
| 1998 | 20-27 June | 20 June | 22 June |
| 1999 | 12-17 June | 24 June | 26 June |
| 2000 | 14-27 June | 30 June | 30 June |
| 2001 | 11-23 June | 22 June | 19 June |
| 2002 | 16-27 June | 10 July | 3 July |
| 2003 | 13-21 June | 30 June | 30 June |
| 2004 | 19-26 June | 5 July | 5 July |
| 2005 | 15-24 June | 26 June | 24 June |
| 2006 | 13-18 June | | 20 June |
| 2007 | 21-27 June | | 10 July |
| 2008 | 13-18 June | | 22 June |
| 2009 | 20-26 June | | 3 July |

Breeding Pair and Total Population Estimates

The estimated number of breeding pairs on the Ungava Peninsula (regions 1,2, and 3) in 2009 (176,118 pairs, SE = 14,421) was similar to the 2008 estimate of 169,699 pairs (SE = 14,331) (P = 0.749) (Table 2, Figure 2). The total population estimate ((indicated pairs x 2) + non-breeders) in 2009 (1,097,744 individuals; SE = 87,555) was similar to the 2008 estimate of 988,977 individuals (SE = 81,129) (P = 0.322). The total population estimate includes breeding pairs, non-breeders (i.e., those

not of breeding age), failed breeders, and molt migrants from other areas and should therefore be interpreted cautiously.

Table 2. Number of Canada goose breeding pairs estimated for the Ungava Peninsula (regions 1,2 and 3) of northern Québec.

| Year | Total Area (km²) | Surveyed Area (km²) | N Transects | Pairs /km² (SE) | Total Pairs (SE) |
|---|---|---|---|---|---|
| 1988 | 222700 | 575 | 16 | 0.53 (0.068) | 118031 (15144) |
| 1993 | 222700 | 838 | 35 | 0.41 (0.056) | 91307 (12471) |
| 1994 | 222700 | 1214 | 36 | 0.18 (0.020) | 40086 (4454) |
| 1995 | 222700 | 1211 | 36 | 0.13 (0.013) | 29302 (2967) |
| 1996 | 222700 | 1211 | 36 | 0.21 (0.023) | 46058 (5052) |
| 1997 | 222700 | 1239 | 36 | 0.28 (0.028) | 63216 (6201) |
| 1998 | 222700 | 1214 | 36 | 0.19 (0.023) | 42166 (5009) |
| 1999 | 222700 | 1208 | 35 | 0.35 (0.040) | 77451 (8792) |
| 2000 | 222700 | 1107 | 34 | 0.42 (0.044) | 93230 (9850) |
| 2001 | 222700 | 1029 | 31 | 0.66 (0.073) | 146662 (16185) |
| 2002 | 222700 | 1214 | 36 | 0.74 (0.068) | 164840 (15169) |
| 2003 | 222700 | 1208 | 36 | 0.71 (0.055) | 156937 (12273) |
| 2004 | 222700 | 1181 | 35 | 0.79 (0.068) | 174793 (15049) |
| 2005 | 222700 | 1214 | 36 | 0.73 (0.057) | 162395 (12622) |
| 2006 | 222700 | 838 | 28 | 0.72 (0.074) | 160020 (16419) |
| 2007 | 222700 | 1162 | 34 | 0.89 (0.075) | 195709 (16621) |
| 2008 | 222700 | 1188 | 36 | 0.76 (0.064) | 169699 (14331) |
| 2009 | 222700 | 1214 | 36 | 0.79 (0.065) | 176118 (14421) |

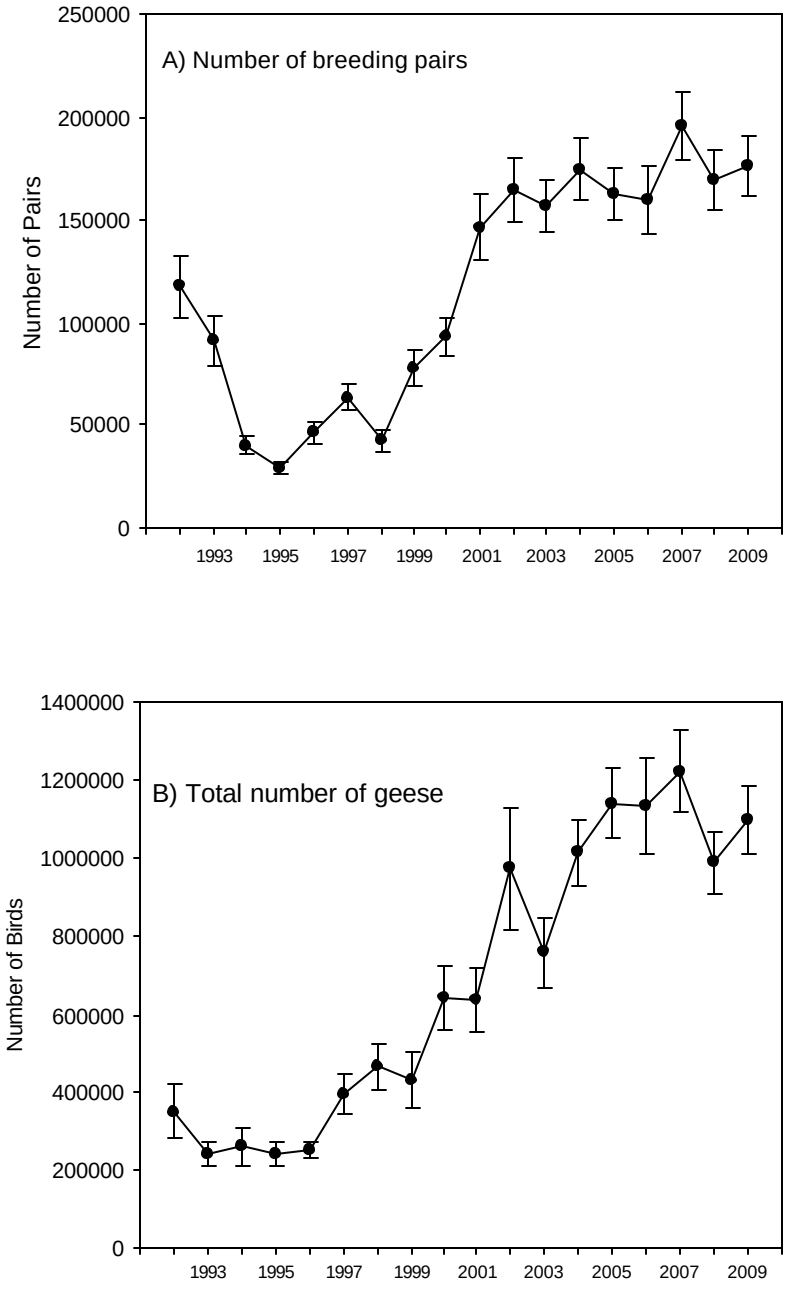


Figure 2. Estimated number (± 1 SE) of Canada goose breeding pairs (A) and total geese (B) on the Ungava Peninsula.

Composition of Indicated Pairs

The number of indicated pairs includes birds recorded as pairs and singles. Single birds are likely to be males associated with an incubating female while pairs include some nesting birds as well as subadult or failed breeders. Therefore, the proportion of indicated pairs observed as singles may provide a more reliable indicator of the proportion of indicated pairs that are actually nesting (see Humburg et al. 1998). The percentage of indicated pairs observed as singles on the Ungava Peninsula was 38% in 2009. This was below average for the 17 years of the survey (range = 34-62%, mean = 51%), consistent with other years of poor reproduction (e.g., 2004, 2007), and supports the findings from the nest searches of Ungava Bay study plots in 2009 (i.e., late initiation date and below-average clutch size) (R. Cotter, pers. comm.).

Comparison of Hudson and Ungava Bay Coasts

From 1993-2000, the estimated density of breeding pairs was similar in the Hudson and Ungava Bay coastal zones, although density along Hudson Bay tended to be slightly higher (Figure 3). Since 2001, the pair density along Hudson Bay has exceeded the density along Ungava Bay (Figure 3). The estimated density of breeding pairs increased 15% along the Hudson Bay coast and increased 4% on the Ungava Bay coast in 2009 compared to 2008 (Figure 3). The estimated density of total geese increased 20% on the Hudson Bay coast (2009: 19.5 geese/km2; 2008: 16.3 geese/km2) and increased 67% along Ungava Bay (2009: 3.5 geese/km2; 2008: 2.1 geese/km2) compared to 2008. The percentage of indicated pairs observed as singles was low and similar in the coastal zones along Hudson Bay (38%) and Ungava Bay (33%) in 2009.

The coastal habitat bordering Hudson Bay and Ungava Bay is well known for its high density of breeding Canada geese (Malecki and Trost 1990). However, the Hudson Bay coast supports a much larger breeding population than the Ungava Bay coast. The smaller breeding population along the Ungava Bay coast is partly a function of less land area (Ungava Bay: 9,700 $km^2$; Hudson Bay: 33,800 $km^2$) and until recently, a slightly lower density of breeding pairs in most years. The difference in density of breeding pairs has become much more obvious since 2001 (Figure 3); the Hudson Bay coast now supports about four times the density of breeding pairs than are found on the Ungava Bay coast. This could be related to a number of factors including differential survival or productivity. Productivity surveys have measured lower nest success for

geese along the Ungava coast (1996-2005 mean = 52%) than along Hudson Bay (1996-2005 mean = 76%) (Cotter 2006). Similarly, we often observe a lower percentage of single geese along Ungava Bay than Hudson Bay, perhaps indicative of the loss of nests. Whatever the cause, it is increasingly clear that in recent years the potential for growth is more limited for geese nesting along the Ungava Bay coast. Modeling may be useful to examine whether differences in nest success could explain the different population trajectories.

Prior to 2003, the density of breeding pairs was similar on northern and southern transects along the Ungava Bay coast (Figure 4). Since 2003, we have observed a shift in distribution. Northern transects now support higher densities of breeding pairs than southern transects along Ungava Bay (Figure 4). We have not observed a similar shift in distribution on the Hudson Bay coast.

We believe the survey regions should be reconfigured to consider the Hudson and Ungava Bay portions of the coastal zone as separate units. The Ungava Bay portion of the coastal region accounts for 22% of the land area in Region 2, but nearly 36% of the transect segments in Region 2 are located along Ungava Bay. This had little effect in the early years of the survey when the pair densities were similar along both coasts (Figure 3). However, with the large and growing difference in density that is currently observed (Figure 3), over-sampling in the Ungava Bay portion of the coastal region is causing estimates to be biased low. For example, in 2009, the total pair estimate was 176,118 (SE = 14,421) with 3 strata (i.e., combining the Hudson and Ungava Bay coasts). With 4 strata (i.e., separating the Hudson and Ungava coasts), the total pair estimate is 189,627 (SE = 16,552). The loss of precision is quite small (CV = 8.2% with 3 strata and 8.6% with 4 strata).

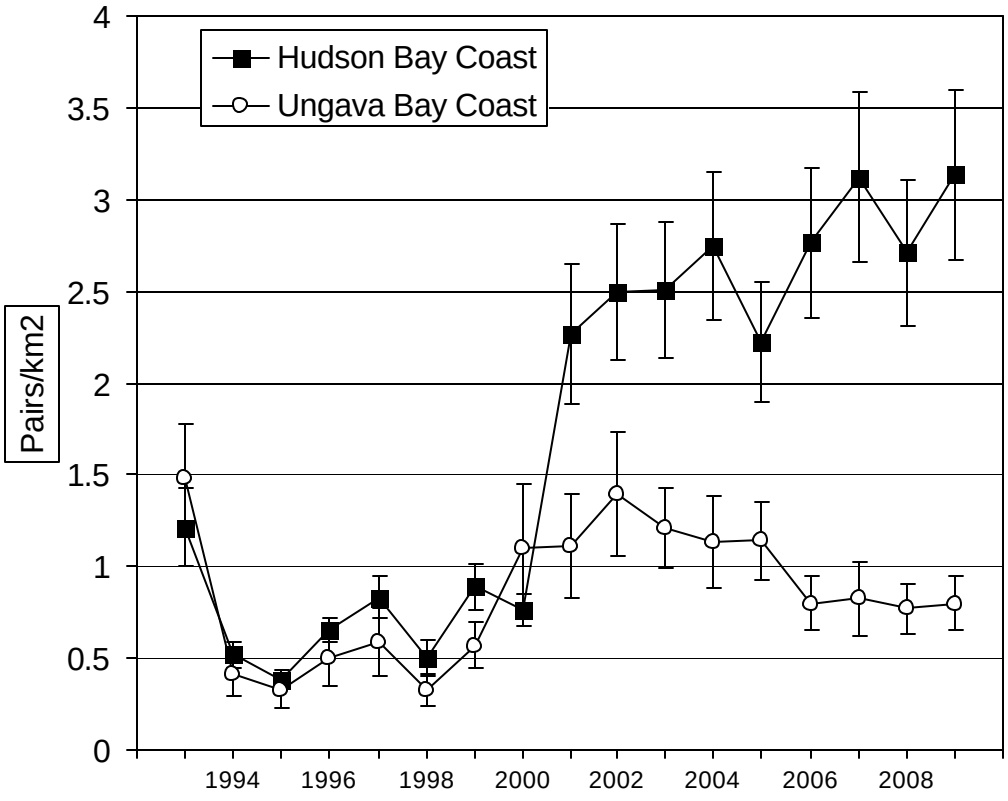


Figure 3. Average density (± 1 SE) of breeding Canada goose pairs for the coastal zones along Hudson Bay and Ungava Bay.

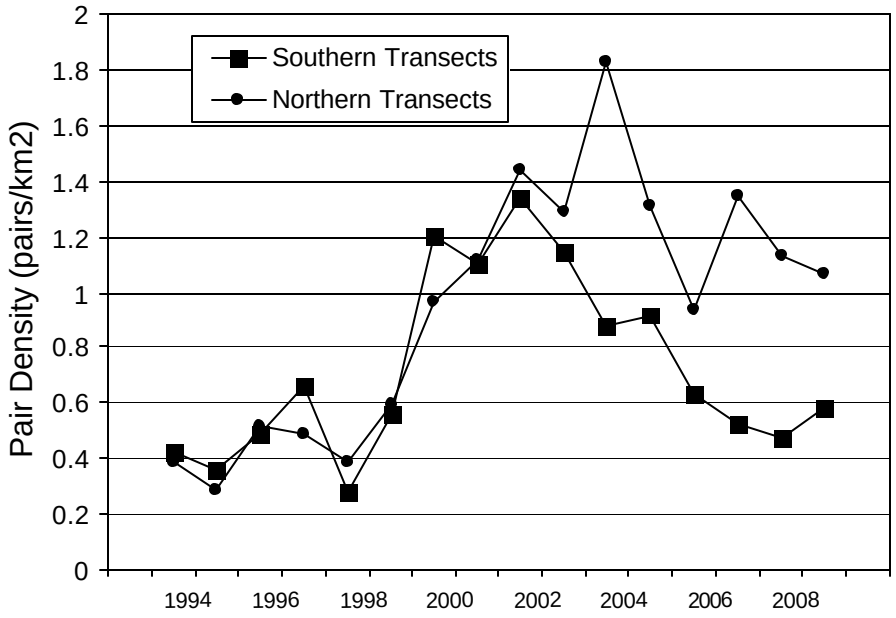


Figure 4. Density of breeding pairs on northern (north of Leaf River; >59º latitude) and southern (south of Leaf River; <59º latitude) transects along the Ungava Bay coast, 1994-2009.

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